Fisheries and Oceans Canada | Pêches et Océans Canada
Science | Sciences
Canadian Science Advisory Secretariat
Maritimes Region | Science Response 2014/037

STATUS OF ATLANTIC SALMON IN SALMON FISHING AREAS (SFAS) 19-21 AND 23

Context

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) identified four large groups of Atlantic Salmon, referred to as Designatable Units (DUs), in the Maritimes Region: the Outer Bay of Fundy (OBoF; corresponding to the western part of Salmon Fishing Area or SFA, 23), the Nova Scotia Southern Upland (SU; SFAs 20, 21 and part of 22), the inner Bay of Fundy (iBoF; part of SFAs 22 and 23), and Eastern Cape Breton (ECB; SFA 19) (see Appendix 1).

Abundance of Atlantic Salmon in the Maritimes Region has been in decline for more than two decades. Populations in many rivers are extirpated and iBOF salmon are listed as Endangered under the Species at Risk Act (SARA). In November 2010, COSEWIC assessed the OBoF, SU, and ECB population assemblages as Endangered. DFO is currently undergoing the process of developing a SARA listing recommendation for these DUs. Scientific Recovery Potential Assessments have been completed and DFO is in the final stages of consultations with stakeholders, partners, Aboriginal organizations and the public on the potential listing of the SU and ECB DUs. Consultations on the potential listing of the OBoF DU are planned for the summer of 2014. The Region will use the feedback from these consultations, the outcomes of the scientific advisory process and socio-economic analyses to inform a recommendation to the Minister about whether the species should be listed under SARA or not.

Science advice on the status of Atlantic Salmon in SFAs 19-21 and 23 for 2013 was requested by Fisheries and Aquaculture Management. This advice is used to inform Aboriginal communities, clients, and the provinces of Nova Scotia and New Brunswick of the status of the salmon resource in advance of developing harvest agreements and recreational fishing plans for 2014. Given that this request was for an update of previous advice using established methods (e.g., DFO 2013), it was decided to use the Science Response Process. DFO Science plans to provide annual updated advice on the status of Atlantic Salmon stocks within the Maritimes Region over the next five years via this process.

This Science Response Report results from the Science Response Process of March 11, 2014, on the Status of Atlantic Salmon in Salmon Fishing Areas (SFAs) 19-21 and 23 (OBoF DU only).

Analysis and Response

Methods

Evaluation of the status of Atlantic Salmon in the Maritimes Region is based on abundance monitoring for a number of index populations. For most index populations, status is evaluated using a comparison of the estimated egg deposition (calculated from the estimated abundance and biological characteristics of salmon stocks) relative to a reference point known as the conservation (egg) requirement. The river-specific conservation (egg) requirement is based on an egg deposition of 2.4 eggs/m^2 multiplied by the amount of accessible fluvial rearing (of suitable gradient) habitat. An egg deposition of 2.4 eggs/m^2 is considered to be a *Limit Reference Point* in the context of DFO's Precautionary Approach Framework (DFO 2009, DFO 2012, Gibson and Claytor 2012). Conservation requirements for many of the rivers in the Maritimes Region are reported in O'Connell et al. (1997).

Eastern Cape Breton (SFA 19)

Salmon population monitoring by DFO in eastern Cape Breton is currently focused on three river systems: Middle, Baddeck, and North rivers (Table 1). Parks Canada monitors adult salmon abundance on Clyburn Brook using dive surveys similar to those conducted by DFO. The Unama'ki Institute of Natural Resources (UINR) also conducted a smolt population assessment on Middle River in 2013. Details on the assessment methods for ECB salmon populations are provided in DFO (2013), Gibson and Bowlby (2009), and Robichaud-LeBlanc and Amiro (2004).

In 2013, all rivers within SFA 19 with the exception of Middle, Baddeck, and North were closed to salmon fishing all year. Middle and Baddeck rivers were open to catch-and-release angling from October 1st to October 31st and North River (downstream from the area known as the "The Benches") was open to catch-and-release angling from June 1st to July 15th and September 1st to October 31st (Table 1). A provincial stocking program exists on Middle and Baddeck rivers, which aims to numerically offset anticipated catch and release mortalities on these rivers (DFO 2010). Food, Social and Ceremonial (FSC) allocations were available to First Nations on these three rivers in 2013.

A summary of the 2013 assessment results is provided in Table 1 and time series showing the status of adult salmon populations for Middle and Baddeck, North, and Clyburn rivers are provided in Figures 1, 2, and 3, respectively. In 2013, the North River population was assessed to be slightly above the conservation (egg) requirement for the river (Table 1, Figure 2), whereas the Middle River and Baddeck River populations remained below the conservation (egg) requirements for those rivers achieving 88 and 50 percent of the requirements, respectively (Table 1, Figure 1). The analyses for Middle and Baddeck rivers (Table 1, Figure 1) indicate a very low probability (<0.1%) of Baddeck River achieving the conservation (egg) requirement in 2013, whereas there is a low probability (20%) that the salmon abundance in Middle River was slightly above the number of spawners required to achieve the conservation (egg) requirement in 2013. Abundance in Clyburn Brook continues to remain low with only three large salmon counted in 2013.

Table 1. Salmon angling seasons, available assessment information, conservation (egg) requirements, preliminary recreational catch and effort, catch and release mortality estimates, dive count results, estimated escapement, percent conservation (egg) requirement attained, Provincial stocking information, and smolt population estimate for index rivers in SFA 19 during 2013.

	MIDDLE RIVER	BADDECK RIVER	NORTH RIVER	CLYBURN BROOK
Angling Season (2013)	October 1 - 31	October 1 - 31	June 1 - July 15 & September 1 - October 31	Closed
Assessment Information	-Recreational Catch Estimates -Dive Counts -Mark Recapture Data -Electrofishing Data -Smolt Estimate	-Recreational Catch Estimates -Dive Counts -Mark Recapture Data -Electrofishing Data	-Recreational Catch Estimates -Dive Counts -Mark Recapture Data	-Dive Counts
Conservation (egg) Requirement (millions of eggs)	2.07	2.01	0.92	0.28
Preliminary Recreational Catch Estimates*:				
Small salmon	15	12	54	NA
Large salmon	266	162	340	NA
Effort (rod-days)	637	444	560	NA
Total Salmon Catch and Release Mortality Estimates**	11-12	6-7	15-16	NA
Dive Count:				
Small salmon***	25	11	14[a], 21[b]	0
Large salmon***	340	87	106[a], 115[b]	3
Marks / Recaptures	NA	NA	11[a,b] / 6[a], 3[b]	NA
Estimated Escapement:				
Small salmon***	28	18	37[c]	NA
Large salmon***	512	193	232[c]	NA
% Conservation (egg) Requirement (Bayesian 90% credible interval)	88 (68 - 113)	50 (38 - 65)	105	NA
Provincial Stocking:				
Broodstock Collections	6 large salmon (October)	8 large salmon (October)	NA	NA
Juvenile Releases	13,000 fin clipped parr (November)	0	NA	NA
Smolt Population Estimate (95% C.I.)****	10,943 (6,829 - 15,057)	NA	NA	NA
Fish / 100 m^2	1.41	NA	NA	NA

Table Notes: NA = Not Applicable.

* Salmo-NS Database queried on February 25, 2014

** An assumed 4% mortality rate is applied to estimate catch-and-release mortalities (see DFO 2013).

*** Two dive surveys were conducted on North River in 2013 (i.e., (a) October 24th, and (b) October 31st) and the results are reported respectively. The small and large dive count values reported for North River include marked and unmarked fish. The mean escapement estimate from the two dive surveys on North River is reported. For individual dive surveys, small and large escapement estimates were calculated using mean observation rates for dive surveys conducted on North River since 1994 and the proportion of large and small salmon observed during each respective survey in 2013.

**** Source: UINR

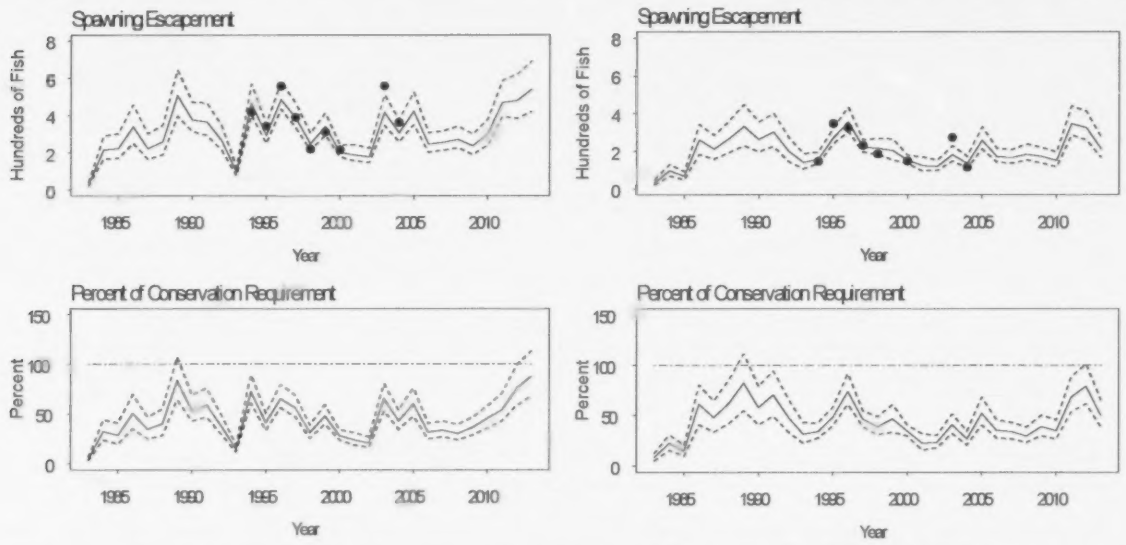

Figure 1. Estimated total number of spawners (top graph) and the percent of the conservation (egg) requirement attained (bottom graph) for Middle River (left panel) and Baddeck River (right panel), NS, from 1983 to 2013. Model fits derived using two methods are shown. The solid lines show the maximum likelihood estimates of annual abundance. The dashed lines show the Bayesian 90% credible interval for the annual abundance estimates. The points in the top graphs are the population estimates obtained by mark recapture during the dive surveys. The horizontal dashed line in the bottom graphs indicates 100% of the conservation (egg) requirement for each river.

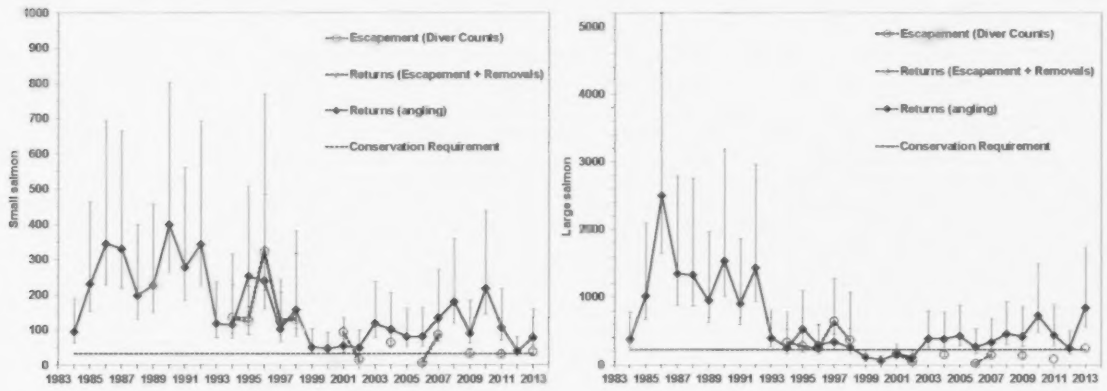

Figure 2. Estimates of the number of salmon returning to spawn and the spawning escapement for large and small salmon in the North River, NS, as derived from dive survey counts and from recreational catch data. The expected number of large or small salmon necessary to meet the conservation requirement is shown by the horizontal dashed line. Error bars are 90% confidence intervals.

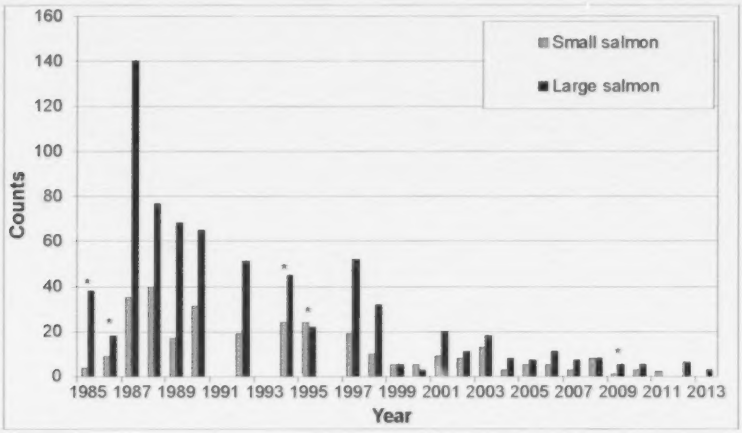

Figure 3. Counts of large and small salmon in Clyburn Brook, NS, from 1985 to 2013. Years in which only the lower section of the river was surveyed (partial counts) are identified with an asterisk (*). Source: Parks Canada.

Southern Upland of Nova Scotia (SFAs 20, 21 and Part of SFA 22)

Atlantic Salmon assessment activities in the Southern Upland region are currently focused on two populations: the St. Mary's River, the index population for SFA 20, and the LaHave River, the index population for SFA 21. Beginning in 2010, all rivers within SFA 20 and SFA 21 were closed to recreational fishing for Atlantic Salmon and there were no FSC allocations for Atlantic Salmon. Details on the assessment methods for SU salmon populations are provided in DFO (2013) and Gibson et al. (2009).

A summary of the 2013 assessment results is provided in Table 2, and time series showing adult returns and estimated egg deposition in the LaHave River above Morgan Falls are provided in Figure 4. In 2013, the LaHave River salmon population above Morgan Falls remained below the conservation (egg) requirement with an estimated egg deposition of 12 percent of the requirement. Fry and total parr (age one and older) densities on the St. Mary's and LaHave rivers were also low and remain below Elson's Norm values (Elson 1967) of 29 fry/100m^2 and 38 parr/100m^2 (Table 2).

Table 2. Salmon angling seasons, available assessment information, conservation (egg) requirements, fishway count, percent conservation (egg) requirement attained, and juvenile and smolt assessment results for index rivers in SFA 20 and 21 during 2013.

	ST. MARY'S RIVER	LAHAVE RIVER (ABOVE MORGAN FALLS)
Angling Season (2013)	Closed	Closed
Assessment Information	- Juvenile Electrofishing Surveys	- Juvenile Electrofishing Surveys (above and below Morgan Falls) - Smolt Assessment - Fishway Count
Conservation (egg) Requirement (millions of eggs)	9.56	6.22*
Fishway Count**		
Small salmon	NA	75
Large salmon	NA	111
% Conservation (egg) Requirement	NA	12
Juvenile Electrofishing:		
Number of Sites	14	8
Juvenile Densities (fish/100m^2):		
Age-0 Parr (Fry)	5.8	6.0
Total Age-1 and Older Parr	9.0	8.2
Smolt Population Estimate		7,159
(95% C.I.)	NA	(5,237 – 10,259)
Fish/100 m^2	NA	0.28

Table Notes:
NA = Not Applicable. * The conservation (egg) requirement reported by O'Connell et al. (1997) has been scaled according to the proportion of habitat area above Morgan Falls (i.e., 51%). ** Corrected for observed fallbacks.

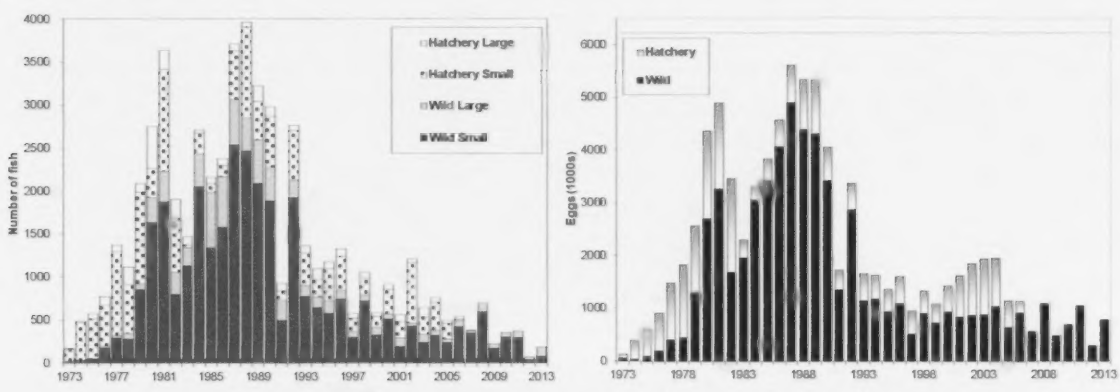

Figure 4. Counts of small and large adult Atlantic Salmon (left panel) and estimated egg deposition (1000's) relative to the conservation (egg) requirement (right panel) by wild-origin and hatchery-origin at the Morgan Falls fishway on the LaHave River, NS, from 1973 to 2013. The horizontal dashed line in the right panel indicates 100% of the conservation (egg) requirement above Morgan Falls.

Outer Bay of Fundy (Outer Portion of SFA 23)

Atlantic Salmon assessment activities in the outer Bay of Fundy region are currently focused on two river systems: Saint John River (Upriver of Mactaquac Dam, which includes the Tobique tributary) and Nashwaak River (tributary of Saint John River downriver of Mactaquac Dam). The Atlantic Salmon Federation monitors adult salmon abundance on the Magaguadavic River. A detailed assessment updating status to 2012 for the OBoF population was completed for the Recovery Potential Assessment of this DU (Jones et al. 2014).

All commercial fisheries for Atlantic Salmon in SFA 23 have been closed since 1984. Low abundance of salmon has resulted in no allocations for Aboriginal fisheries for FSC purposes and no recreational fisheries since 1998. In 2013, all rivers within SFA 23 remained closed to salmon fishing all year.

The Mactaquac Biodiversity Facility was constructed to numerically offset the effects of hydroelectric development on salmon in the Saint John River, primarily by producing smolts from sea-run broodstock captured at fish collection facilities at Mactaquac Dam. Since 2004, the program at the Mactaquac Biodiversity Facility was refocused on conserving and restoring a declining resource utilizing captive-reared adults, originally collected from the wild as juveniles, for both broodstock and adult releases for natural spawning upriver of Mactaquac Dam (Jones et al. 2004).

A summary of the 2013 assessment results is provided in Table 3, and time series showing the status of salmon populations for Saint John (upriver of Mactaquac Dam) and Nashwaak rivers are provided in Figures 5 - 8. Returns to the three index rivers in 2013 remain below conservation (egg) requirements and have all been estimated to contribute less than 7% of the requirements (Table 3). Fry and total (age one and older) parr densities on the Tobique River and Nashwaak River were also low and remain below Elson's Norm (Elson 1967) values of 29 fry/100m^2 and 38 parr/100m^2 (Table 3).

Table 3. Available salmon assessment information for Index Rivers in SFA 23 during 2013 which includes conservation (egg) requirement, fishway/fence counts, estimated returns, percentage of conservation (egg) requirement met, captive-reared releases, and juvenile and smolt assessment results.

	SAINT JOHN RIVER (ABOVE MACTAQUAC DAM)	NASHWAAK RIVER (ABOVE DURHAM BRIDGE)	MAGAGUADAVIC RIVER
Angling Season (2013)	Closed	Closed	Closed
Assessment Information	- Fishway Count - Juvenile Electrofishing Surveys - Pre-smolt Assessment	- Counting Fence - Juvenile Electrofishing Surveys (above and below Counting Fence) - Smolt Assessment	-Fishway Count
Conservation (egg) Requirement (millions of eggs)	32.30	5.35[a]	1.35
Fishway or Fence Count:			
1SW (one-sea-winter) salmon*	291	57	3
MSW (multi-sea-winter) salmon*	132	35	3
Marks / Recaptures	NA	6 marked, 13 unmarked	NA
Estimated Returns:			
1SW salmon*	294	180	3
MSW salmon*	136	110	3
% Conservation (egg) requirement	2	6	<1
Captive-reared Adult Releases	385	NA	NA
Electrofishing Densities (fish/100m^2):			
Number of Sites	11	6	NA
Age-0 parr (fry)	7.2[b]	0.9	NA
Age-1 and older parr	2.5[b]	7.5	NA
Wild-origin Pre-smolt or Smolt Estimate (2.5 and 97.5 percentiles)	16,490[b] (13,040-22,040)	10,120 (8,840-11,800)	NA
Pre-smolt or Smolt (fish/11m^2)	0.21[b]	0.19	NA

Table Notes:
NA = Not Applicable, * One-sea-winter (1SW) salmon are those which return to spawn following a single winter at sea (also termed Grilse). Multi-sea-winter (MSW) salmon include those fish which return following two or more winters at sea and repeat spawning salmon. [a] The conservation (egg) requirement reported by Marshall et al. (1997) is calculated based on the habitat area above the counting fence (above Durham Bridge) on the Nashwaak River (i.e., 90%). [b] Electrofishing and pre-smolt results are for the Tobique River (index tributary upriver of Mactaquac Dam).

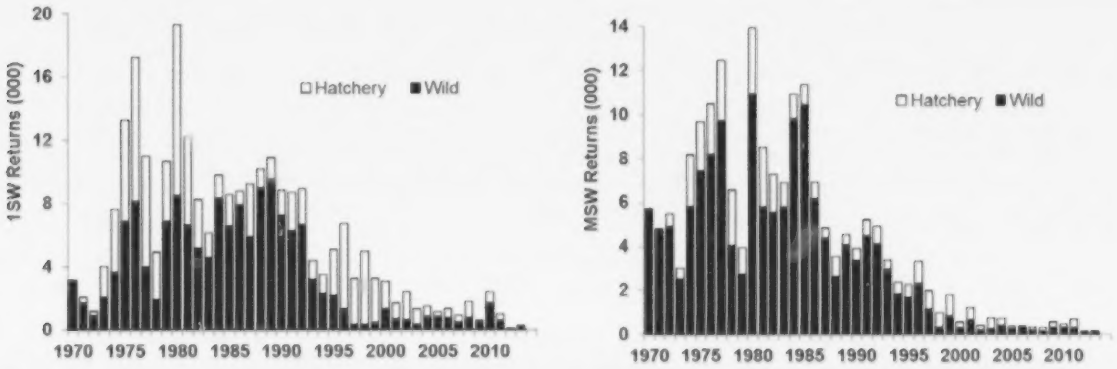

Figure 5. Estimated wild and hatchery-origin 1SW and MSW returns destined for upriver of Mactaquac Dam, Saint John River, 1970-2013.

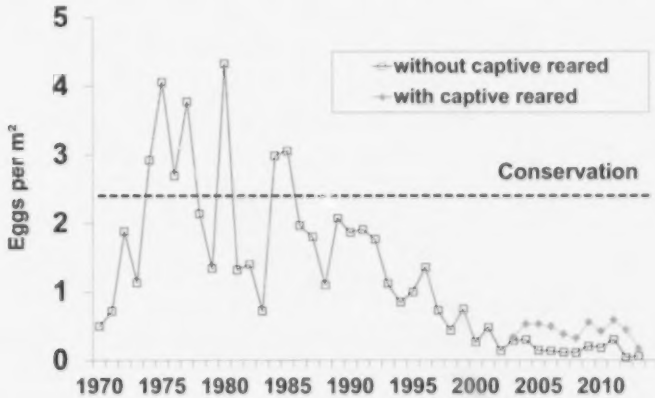

Figure 6. Estimated egg deposition (wild and hatchery combined, and captive-reared) upriver of Mactaquac Dam, Saint John River, 1970-2013. The horizontal dashed line is the conservation (egg) requirement.

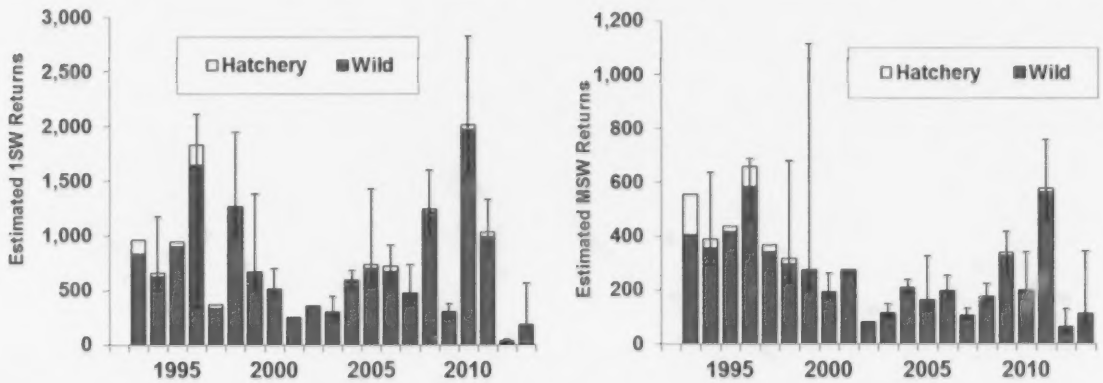

Figure 7. Estimated wild and hatchery-origin 1SW and MSW salmon returns (and 2.5 and 97.5 percentiles) to the Nashwaak River, 1993-2013.

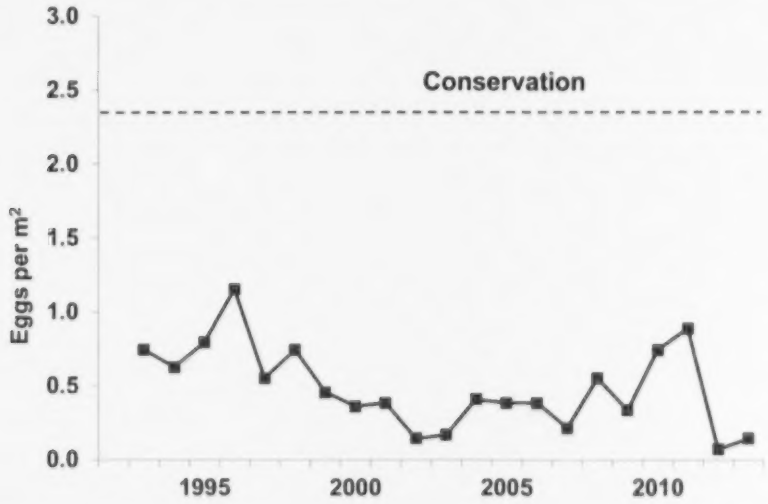

Figure 8. Estimated egg deposition upriver of the counting fence operated just below Durham Bridge, Nashwaak River, 1993-2013. The dashed line is the conservation (egg) requirement.

Sources of Uncertainty

There were informal reports of illegal fishing activities (e.g., fishing in closed areas, poaching) and a minimum estimate of 18-20 salmon removed illegally from Middle River in 2013, but the combined contribution of these activities to the depressed status of populations is not known.

The number of small and large salmon caught and released, fishing effort, and catch and release mortality within SFA 19 is estimated from license stub returns from the recreational salmon fishery. Catch and effort values are adjusted for non-returned stubs using a relationship based on the reported catch as a function of the number of reminder letters sent to licensed anglers. These estimates are considered to be preliminary at the time of this assessment update, as license sale information and license stubs are still being returned for 2013. Since 2002, North River preliminary catch and effort estimates calculated prior to sending reminder letters have been systematically higher than estimates calculated after the first reminder letter has been sent to anglers with the most pronounced discrepancies observed from 2005 onward. Systematic discrepancies have not been as pronounced for recreational catch estimates on Middle and Baddeck rivers. Under- or over-reporting of numbers of salmon caught and fishing effort would impact assessment results based on angling data. These observations coupled with the observation that the North River salmon abundance estimated from the recreational catch has consistently exceeded the abundance estimated from dive counts since 2002 indicate that the recreational catch data should be interpreted with caution and field surveys should be conducted to assess whether the current use of recreational catch data is appropriate for future assessments.

The total number of salmon harvested under Aboriginal fishing agreements in SFA 19 was not available at the time of this assessment. Preliminary reports from four of the five First Nation communities with allocations on North River indicate these communities did not remove any salmon from the North River in 2013. There are no Atlantic Salmon allocations for Aboriginal fisheries in SFAs 20, 21 and 23.

Although some populations in eastern Cape Breton are closer to their conservation (egg) requirements than those in the Outer Bay of Fundy and Southern Upland regions, substantial

declines are evident in other ECB populations (e.g., Grand and Clyburn rivers). There is uncertainty in the status of populations in non-index rivers, which has been inferred from recreational catch data and limited electrofishing data (DFO 2014).

Further details on uncertainty with these assessment methods can be found in DFO (2013).

Conclusions

Overall, this assessment update indicates that the abundance of Southern Upland and Outer Bay of Fundy Atlantic Salmon remains critically low. Adult salmon returns to the LaHave River (Southern Upland), the Saint John River upriver of Mactaquac Dam, and the Nashwaak River (outer Bay of Fundy) remain among the lowest returns on record with estimated egg depositions ranging between 2 - 12% of conservation (egg) requirements in 2013.

Some populations in eastern Cape Breton are closer to conservation (egg) requirements than those in the Outer Bay of Fundy and Southern Upland regions. The estimated egg deposition for salmon escapement in the North River was assessed to be slightly above the conservation (egg) requirement for the river in 2013. Estimated egg depositions in Middle River increased for the fifth consecutive year in 2013; however, estimated egg depositions for both Middle River and Baddeck River populations remained below conservation (egg) requirements in 2013.

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May 15, 2014

Sources of Information

This Science Response Report results from the Science Response Process of March 11, 2014, on the Status of Atlantic Salmon in Salmon Fishing Areas (SFAs) 19-21 and 23.

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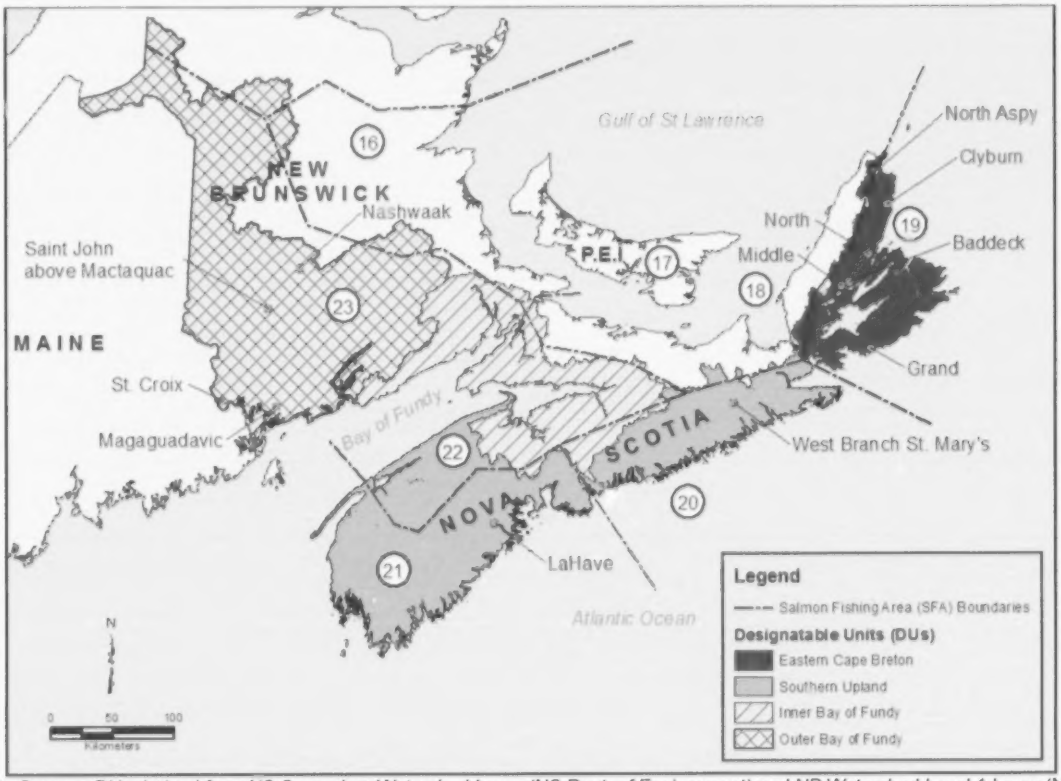
Appendices

Appendix 1. Map showing the locations of Atlantic Salmon rivers, Salmon Fishing Areas (SFAs), and COSEWIC DUs mentioned in this update and recent status assessments.

Note: SFA numbers are labeled inside the white circles.



Data Source: DUs derived from NS Secondary Watershed Layer (NS Dept. of Environment) and NB Watershed Level 1 Layer (NB Dept. of Natural Resources).

This Report is Available from the

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